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TRANSACTIONS

OF THE

KANSAS

ACADEMY OF SCIENCE

VOL. XXX

FIFTY-FIRST ANNUAL MEETING, MANHATTAN,
APRIL 18-19, 1919

FIFTY-SECOND ANNUAL MEETING, PITTSBURG,
APRIL 23-24, 1920

FIFTY-THIRD ANNUAL MEETING, LAWRENCE,
FEBRUARY 18-19, 1921

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PART I.

CONSTITUTION OF THE ACADEMY.

SECTION 1. This association shall be called the Kansas Academy of Science.

SEC. 2. The objects of this Academy shall be to increase and diffuse knowledge in the various departments of science.

SEC. 3. The members of this Academy shall consist of two general classes—honorary and active.

(1) *Active members* shall be classified as local members and national members. Local members shall be those who are members of this Academy only. Local members may be elected at any time by the committee on membership, which shall consist of the secretary and two other members appointed by the president, annually. Annual members shall pay a fee of one dollar and annual dues of one dollar; but the secretary and treasurer shall be exempt from the payment of dues during the years of their service. Any person who shall at one time contribute $20 to the funds of this Academy may be elected a *life member* of the Academy, free of assessment. Any member who has paid dues to the Academy for ten consecutive years, or who has been legally exempt during any portion of that time, may be elected a *life member* on the payment of $10. Any member who has been a member of this Academy in good standing for twenty years may be elected a *life member* without payment of further fees or dues. *Honorary members* may be elected on account of special prominence in science, on the written recommendation of two members of the Academy. In any case, a two-thirds vote of members present shall elect to honorary or life membership.

(2) *National members* shall consist of those who are also members of the American Association for the Advancement of Science.

Each national member, except life members of the Academy, shall pay or shall have paid an initiation fee of one dollar to this Academy, and shall pay an annual fee equal to the annual fee assessed by the American Association for the Advancement of Science. The Academy shall be entitled to one dollar annually as its share of the above fee. Life members of the Academy shall pay the assessment of the American Association for the Advancement of Science less one dollar, and all of this shall be sent to the American association.

The classification of members, together with the fees to be paid, is as follows:

1. Honorary. No dues.
2. Active.
   (1) Local.
      (a) Annual. Dues, $1 per year.
      (b) Life. No dues.

(2) National.

(a) Local life, national annual. Dues, $1 less than the assessment of the A. A. A. S.

(b) Local life, national life. No dues.

(c) Local annual, national annual. Dues, an amount equal to the assessment of the A. A. A. S., one dollar of which the Academy shall keep.

(d) Local annual, national life. Dues, $1 per year.

SEC. 4. The officers of this Academy shall be chosen by ballot at the annual meeting, and shall consist of a president, two vice presidents, a secretary and a treasurer, who shall perform the duties usually pertaining to their respective offices. The president, the secretary and the treasurer shall constitute the executive committee. The secretary shall have charge of all the books, collections and material property belonging to the Academy.

SEC. 5. Unless otherwise directed by the Academy, the annual meeting shall be held at such time and place as the executive committee shall designate. Other meetings may be called at the discretion of the executive committee.

SEC. 6. This constitution may be altered or amended at any annual meeting by a vote of three-fourths of attending members of at least one year's standing. No question of amendment shall be decided on the day of its presentation.

SEC. 7. This Academy shall have an executive council, consisting of the president, the secretary, the treasurer, the vice presidents, and four other members to be nominated by the nominating committee and elected as the other officers. This council shall have general oversight of the Academy not otherwise given by this constitution to officers or committees.

BY-LAWS.

I. The first hour, or such part thereof as shall be necessary, in each session, shall be set aside for the transaction of the business of the Academy. The following order of business shall be observed, so far as practicable:

1. Opening.
2. Reports of officers.
3. Reports of standing committees.
4. Appointment of special committees.
5. Unfinished business.
6. New business.
7. Reports of special committees.
8. Election of officers.
9. Election of members.
10. Program.
11. Adjournment.

II. The president shall deliver a public address on the evening of one of the days of the meeting, at the expiration of his term of office.

III. No meeting of this Academy shall be held without a notice of the same having been published in the papers of the state at least thirty days previous.

IV. No bill against the Academy shall be paid by the treasurer without an order signed by the president and secretary.

V. Members who shall allow their dues to remain unpaid for two years, having been annually notified of their arrearage by the treasurer, shall have their names stricken from the roll.

VI. The secretary shall have charge of the distribution, sale and exchange of the published Transactions of the Academy, under such restrictions as may be imposed by the executive committee.

VII. Eight members shall constitute a quorum for the transaction of business.

VIII. The time allotted to the presentation of a single paper shall not exceed fifteen minutes.

IX. No paper shall be entitled to a place on the program unless the manuscript, or an abstract of the same, shall have been previously delivered to the secretary.

PAST PRESIDENTS.

1869, 1870	B. F. Mudge.	1899	E. B. Knerr.
1871–1873	John Fraser.	1900	A. S. Hitchcock.
1874–1878	F. H. Snow.	1901	E. Miller.
1879, 1880	B. F. Mudge.	1902	J. T. Willard.
1881, 1882	J. T. Lovewell.	1903	J. C. Cooper.
1883	A. H. Thompson.	1904	Edward Bartow.
1884, 1885	R. J. Brown.	1905	L. C. Wooster.
1886	E. L. Nichols.	1906	F. O. Marvin.
1887	J. D. Parker.	1907	J. A. Yates.
1888	J. R. Mead.	1908	E. Haworth.
1889	T. H. Dinsmore, jr.	1909, 1910	F. B. Dains.
1890	G. H. Failyer.	1911	J. M. McWharf.
1891	Robert Hay.	1912	F. W. Bushong.
1892	E. A. Popenoe.	1913	A. J. Smith.
1893	E. H. S. Bailey.	1914	W. A. Harshbarger.
1894	L. E. Sayre.	1915	J. A. G. Shirk.
1895	Warren Knaus.	1916	J. E. Todd.
1896	D. S. Kelley.	1917	F. U. G. Agrelius.
1897	S. W. Williston.	1918	L. D. Havenhill.
1898	D. E. Lantz.		

OFFICERS OF THE ACADEMY, 1919.

President, L. D. Havenhill	Lawrence.
First Vice President, R. K. Nabours	Manhattan.
Second Vice President, B. M. Allen	Lawrence.
Treasurer, Acting, L. D. Havenhill	Lawrence.
Secretary, E. A. White	Lawrence.

EXECUTIVE COUNCIL.

A. J. SMITH ..... Emporia.
J. A. G. SHIRK ..... Pittsburg.
DR. J. M. MCWHARF ..... Ottawa.

OFFICERS OF THE ACADEMY, 1920.

President, R. K. NABOURS ..... Manhattan.
First Vice President, BENNETT M. ALLEN ..... Lawrence.
Second Vice President, O. P. DELLINGER ..... Pittsburg.
Treasurer, L. D. HAVENHILL ..... Lawrence.
Secretary, E. A. WHITE ..... Lawrence.

EXECUTIVE COUNCIL.

WARREN KNAUS ..... McPherson.
W. A. HARSHBARGER ..... Topeka.
LEROY HUGHBANKS ..... Anthony.

OFFICERS OF THE ACADEMY, 1921.

President, O. P. DELLINGER ..... Pittsburg.
First Vice President, ROY RANKIN ..... Hays.
Second Vice President, W. P. HAYS ..... Manhattan.
Treasurer, L. D. HAVENHILL ..... Lawrence.
Secretary, E. A. WHITE ..... Lawrence.

EXECUTIVE COUNCIL.

J. T. WILLARD ..... Manhattan.
W. J. BAUMGARTNER ..... Lawrence.
W. A. HARSHBARGER ..... Topeka.
FRANK U. G. AGRELIUS ..... Emporia.

MEMBERSHIP OF THE ACADEMY,

January 1, 1921.

Dates signify date of election in the Academy.

HONORARY MEMBERS.

Marshall A. Barber, Ph. D., 1904.
T. D. A. Cockerell, Ph. D., 1918, 908 Tenth street, Boulder, Colo.
W. S. Franklin, Sc. D., 1897, Cambridge, Mass.
G. P. Grimsley, Ph. D., 1896, Thirty-first and Calvert streets, Baltimore, Md.
A. S. Hitchcock, M. S., 1892, U. S. Department of Agriculture, Washington, D. C.
J. Arthur Harris, Ph. D., 1900, Carnegie Institution, Cold Spring Harbor, Long Island, N. Y
Vernon L. Kellogg, M. S., Leland Stanford, Jr., University, California.
C. E. McClung, 1903, National Research Council, Washington, D. C.
E. V. McCollum, Ph. D., 1902, Johns Hopkins University, Baltimore, Md.
E. L. Nichols, Ph. D., 1897, Cornell University, Ithaca, N. Y.
Elmer S. Riggs, A. M., Field Museum, Chicago, Ill.
George Wagner, Ph. C., 1904, Madison, Wis.

LIFE MEMBERS.

E. H. S. Bailey, Ph. D., 1883, professor of chemistry, University of Kansas, Lawrence, Kan.
Elam Bartholomew, M. C., 1896, mycologist, Stockton.
Edward Bartow, Ph. D., 1897, State University of Iowa, Iowa City, Iowa.
Joshua W. Beede, Ph. D., 1894, professor of geology, University of Texas, Austin, Tex.
F. W. Bushong, Sc. D., 1896, Gulf Refining Company, 2636 Fifth avenue, Port Arthur, Tex.
Rev. John T. Copley, 1903, Olathe, Kan.
F. W. Cragin, Ph. D., 1880, 912 Miguel street, Colorado Springs, Colo.
F. F. Crevecoeur, 1900, Onaga, Kan.
Frank B. Dains, Ph. D., 1902, professor of chemistry, University of Kansas, Lawrence, Kan.
R. B. Dunlevy, M. A., 1896, Southwestern College, Winfield, Kan.
T. L. Eyerly, 1906, Dallas, Tex.
George H. Failyer, M. Sc., 1879, R. F. D. 4, Manhattan, Kan.
A. O. Garrett, 1901, professor of botany, high school, Salt Lake City, Utah.
Edward Curtis Franklin, Ph. D., 1884, professor of chemistry, Leland Stanford, Jr., University, California.
I. D. Graham, 1879, State Board of Agriculture, Topeka, Kan.
Henry Jacob Harnly, Ph. D., 1893, professor of biology, McPherson College, McPherson, Kan.
William Asbury Harshbarger, B. Sc., 1903, professor of mathematics, Washburn College, Topeka, Kan.
Erasmus Haworth, Ph. D., 1882.
A. W. Jones, B. Sc., 1894, farmer, Sandpoint, Idaho.
W. H. Keller, A. B., 1898, professor of mathematics, Kansas State Normal School, Emporia, Kan.
J. M. McWharf, M. D., 1902, Ottawa, Kan.
Warren Knaus, M. Sc., editor and entomologist, McPherson, Kan.
Grace R. Meeker, A. B., 1899, city librarian, Ottawa, Kan.
C. F. Menninger, M. D., 1903, Topeka, Kan.
Ephriam Miller, Ph. D., 1873, 558 North Lake avenue, Pasadena, Cal.
A. M. Nissen, A. M., 1888, farmer, Wetmore, Kan.
Albert B. Reagan, 1904, principal Marsh Pass Indian School, Kayenta, Ariz.
Lucius E. Sayre, B. Sc., Ph. M., 1885, dean School of Pharmacy, University of Kansas, Lawrence, Kan.
Edwin Taylor Shelly, M. D., 1892, Atchison, Kan.
Alva J. Smith, 1893, city engineer, Emporia, Kan.
E. G. Smyth, 1901, entomologist, Santa Rica, P. R.
Mrs. Lumina C. Riddle Smyth, Ph. D., 1902, Munden, Kan.
Charles H. Sternberg, 1896, vertebrate paleontologist, Balboa Park, Cal.

Nilan L. Ward, D. D., 1880, emeritus professor of mathematics, Ottawa University, Ottawa, Kan.

Julius T. Willard, Sc. D., 1883, vice president Kansas State Agricultural College, Manhattan, Kan.

Lyman C. Wooster, Ph. D., 1889, professor of zoölogy and geology, Kansas State Normal School, Emporia, Kan.

John E. Welin, Sc. D., 1889, professor of chemistry and physics, Bethany College, Lindsborg, Kan.

James A. Yates, M. Sc., 1898, professor of chemical and physical sciences, Kansas State Manual Training Normal School, Pittsburg, Kan.

ANNUAL MEMBERS.

James E. Ackert, Ph. D., 1917, associate professor of zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Frank U. G. Agrelius, A. M., 1905, associate professor of bacteriology and botany, Kansas State Normal School, Emporia, Kan.

Florence M. Alsop, A. B., 1918, assistant in zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Herman C. Allen, Ph. D., 1904, professor of chemistry, University of Kansas, Lawrence, Kan.

Bennett M. Allen, Ph. D., 1913, professor of zoölogy, University of Kansas, Lawrence, Kan.

Forrest N. Anderson, A. M., 1918, medical student, Lawrence, Kan.

Jane K. Atwood, M. Sc., department of geography, Kansas State Normal School, Emporia, Kan.

W. E. Barker, M. D., 1916, Chanute, Kan.

W. V. Bass, A. B., 1917, instructor in physical sciences, State Manual Training Normal School, Pittsburg, Kan.

W. J. Baumgartner, A. M., 1904, associate professor of zoölogy, University of Kansas, Lawrence, Kan.

F. G. Bedell, 1904, Dodge City, Kan.

L. Jean Bogert, 1921, teacher of domestic science, Kansas State Agricultural College, Manhattan, Kan.

H. H. Braucher, B. Sc., 1907, professor of manual training, Kansas State Normal School, Emporia, Kan.

Elizabeth Brown, teacher, 1919, Marysville, Kan.

Ray J. Brewster, 1919, assistant professor of chemistry, University of Kansas, Lawrence, Kan.

Alice Lenore Brown, A. B., instructor in zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Charles H. Brooks, 1919, superintendent of schools, Stockton, Kan.

H. W. Brubaker, 1919, associate professor of Chemistry, Kansas State Agricultural College, Manhattan, Kan.

Ernest F. Burain, 1916, Pittsburg, Kan.

Robert D. Bussy, 1917, Centralia, Kan.

Leland D. Bushnell, 1908, M. Sc., professor of bacteriology, Kansas State Agricultural College, Manhattan, Kan.

H. P. Cady, Ph. D., professor of chemistry, University of Kansas, Lawrence, Kan.

M. E. Canty, 1903, Fredonia, Kan.

Vaughn B. Caris, A. M., 1911, assistant professor of mathematics, Kansas State Manual Training Normal School, Pittsburg, Kan.

Grace M. Charles, Ph. D., 1918, department of botany, University of Kansas, Lawrence, Kan.

George E. Coghill, Ph. D., 1918, professor of anatomy, University of Kansas, Lawrence, Kan.

W. E. Connelley, 1916, secretary State Historical Society, Topeka, Kan.

W. A. Cook, M. Sc., 1907, Garrison, Kan.

Robert A. Cooley, B. Sc., 1910, professor of zoölogy and entomology, Montana State College, Bozeman, Mont.

Margaret Coventry, A. B., 1914, instructor in physical sciences, Kansas State Manual Training Normal School, Pittsburg, Kan.

W. M. Crotinger, A. B., 1916, farmer, Bison, Kan.

Arthur J. Culler, B. D., Ph. D., 1917, professor of theology and English, McPherson College, McPherson, Kan.

Bertha L. Danheim, 1919, teacher, Blue Rapids, Kan.

George A. Dean, M. Sc., 1903, professor of entomology, Kansas State Agricultural College, Manhattan, Kan.

Frank L. DeBeukelaer, A. M., 1916, professor of chemistry, University of Chicago, Chicago, Ill.

Howard de Forest, Ph. D., 1921, director of science department, Indianapolis Normal School, Indianapolis, Ind.

Emil O. Deere, A. M., 1905, professor of biology and geology, Bethany College, Lindsborg, Kan.

Samuel A. Deel, Ph. B., 1913, professor of physics, Baker University, Baldwin, Kan.

Oris P. Dellinger, Ph. D., 1909, professor of biology, Kansas State Manual Training Normal School, Pittsburg, Kan.

R. E. Devore, A. B., 1916, teacher, Muscotah, Kan.

A. T. Dunham, 1920, miner, Pittsburg, Kan.

J. Whit Eby, 1903, banker, Howard, Kan.

W. L. Eikenberry, 1919, assistant professor of education, University of Kansas, Lawrence, Kan.

H. M. Elsey, Ph. D., 1919, assistant professor of chemistry, University of Kansas, Lawrence, Kan.

George V. Emery, 1920, teacher of physics, State Manual Training Normal School, Pittsburg, Kan.

Herman C. Erickson, 1921, state superintendent free employment bureau, Topeka, Kan.

Henry L. Fackler, 1918, assistant state entomologist, Knoxville, Tenn.

P. L. Gainey, 1919, professor of bacteriology, Kansas State Agricultural College, Manhattan, Kan.

A. A. Graham, 1910, attorney, Topeka, Kan.

Myrtle Greenfield, 1918, bacteriologist, Lawrence, Kan.

Richard L. Grider, E. M., 1918, assistant professor of mining, University of Kansas, Lawrence, Kan.

L. D. Haverhill, B. Sc., Ph. C., 1904, professor of pharmacy, University of Kansas, Lawrence, Kan.

J. O. Hamilton, 1919, professor of physics, Kansas State Agricultural College, Manhattan, Kan.

Louis Hay, 1921, teacher of physics, Augusta high school, Augusta, Kan.

J. Newton Harrison, 1916, farmer, Topeka, Kan.

Mary T. Harman, Ph. D., 1912, assistant professor of zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Wm. P. Hayes, 1919, assistant professor of entomology, Kansas State Agricultural College, Manhattan, Kan.

A. W. Hayne, 1918, oculist, Lawrence, Kan.

J. Willard Hershey, professor of chemistry, McPherson College, McPherson, Kan.

Amos H. Hersh, A. M., 1918, instructor in zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Frederick L. Hisaw, B. S., A. M., 1921, assistant professor of zoölogy, Kansas State Agricultural College, Manhattan, Kan.

Rudolph Hirsch, 1918, chemist, Ridenour-Baker Grocery Company, Kansas City, Mo.

William E. Hoffman, 1920, assistant curator museum, University of Kansas, Lawrence, Kan.

Leroy Hughbanks, 1914, minister, lecturer, Anthony, Kan.

I. W. Humphrey, M. Sc., 1912, Dover, N. J.

H. B. Hungerford, Ph. D., 1920, associate professor of entomology, University of Kansas, Lawrence, Kan.

W. S. Hunter, Ph. D., 1919, professor of psychology, University of Kansas, Lawrence, Kan.

W. M. Jardine, LL. D., 1919, president Kansas State Agricultural College, Manhattan, Kan.

T. B. Jennings, 1917, director U. S. Weather Bureau, Topeka, Kan.

Ed C. Jerman, 1911, electrician, Topeka, Kan.

Charles E. Johnson, 1921, associate professor of zoölogy, University of Kansas, Lawrence, Kan.

E. G. Kelly, 1921, entomologist, Kansas State Agricultural College, Manhattan, Kan.

F. J. Kelly, Ph. D., 1919, dean of administration, Kansas University, Lawrence, Kan.

Harry L. Kent, B. Sc., 1904, principal School of Agriculture, Kansas State Agricultural College, Manhattan, Kan.

John H. Klopfer, 1904, Topeka, Kan.

Herbert Hiram King, M. Sc., 1909, associate professor of chemistry, Kansas State Agricultural College, Manhattan, Kan.

ANNUAL MEMBERS.

P. E. Laird, A. B., B. S., 1918, teacher of chemistry, State Normal School, Durant, Okla.
H. R. Laing, 1921, teacher of chemistry, Augusta high school, Augusta, Kan.
P. B. Lawson, Ph. D., 1919, professor of entomology, University of Kansas, Lawrence, Kan.
William A. Lewis, LL. D., 1918, president Fort Hays Kansas Normal School, Hays, Kan.
Marcus A. Low, 1906, attorney Chicago, Rock Island & Pacific Railway, Topeka, Kan.
Walter S. Long, A. M., 1913, assistant professor of chemistry, University of Kansas, Lawrence, Kan.
F. A. Marlatt, 1920, manufacturer, Manhattan, Kan.
W. H. Matthews, 1920, teacher of physics, State Manual Training Normal School, Pittsburg, Kan.
Robley D. E. Matthews, miner, Pittsburg, Kan.
Bess J. McKittrick, 1919, teacher, Kansas State Agricultural College, Manhattan, Kan.
James W. McColloch, 1919, teacher, Kansas Experiment Station, Manhattan, Kan.
James B. McNaught, 1919, bacteriologist, University of Kansas, Lawrence, Kan.
Karl A. Menninger, M. D., 1919, Topeka, Kan.
L. E. Melchers, M. S., 1918, associate professor of botany, Kansas State Agricultural College, Manhattan, Kan.
Ella Weeks Menoher, 1903, Manhattan, Kan.
J. H. Merrill, Ph. D., 1919, state apiarist, Manhattan, Kan.
Clarence A. Mills, A. B., 1918, teacher, Medical College, Cincinnati, Ohio.
S. T. Millard, M. D., 1909, Topeka, Kan.
A. J. Mix, Ph. D., 1918, professor of botany, University of Kansas, Lawrence, Kan.
E. C. Miller, Ph. D., 1918, assistant professor of botany, Kansas State Agricultural College, Manhattan, Kan.
Raymond C. Moore, Ph. D., 1918, assistant professor of geology, state geologist, University of Kansas, Lawrence, Kan.
R. L. Moodie, Ph. D., 1908, assistant professor of anatomy, University of Illinois, Chicago, Ill.
Robert Ellsworth Mohler, B. S., A. B., 1914, professor of agriculture, McPherson College, McPherson, Kan.
Mrs. Agnes Anderson Murray, A. M., 1913, Lawrence, Kan.
R. K. Nabours, Ph. D., 1910, professor of zoölogy, Kansas State Agricultural College, Manhattan, Kan.
C. F. Nelson, Ph. D., 1914, associate professor of physiological chemistry, University of Kansas, Lawrence, Kan.
P. J. Newman, 1919, teacher and chemist, Manhattan, Kan.
H. H. Ninninger, 1921, department of botany, McPherson College, McPherson, Kan.
Nadine Nowlin, A. M., 1917, assistant professor of zoölogy, University of Kansas, Lawrence, Kan.
H. N. Olson, A. B., 1905, professor of mathematics, Bethany College, Lindsborg, Kan.
Earl O'Roke, 1917, instructor in zoölogy, South Dakota State College, Brookings, S. Dak.
Fayette T. Owen, Ph. D., 1917, professor of chemistry, College of Emporia, Emporia, Kan.
S. L. Palmer, 1917, Hutchinson, Kan.
John H. Parker, 1918, assistant professor of crops, Kansas State Agricultural College, Manhattan, Kan.
Nellie M. Payne, 1920, assistant in entomology, Kansas State Agricultural College, Manhattan, Kan.
Larry M. Peace, A. M., 1904, demonstrator in botanical laboratories, University of Kansas, Lawrence, Kan.
Irving Perrine, geologist, Oklahoma City, Okla.
John C. Peterson, 1919, teacher, Manhattan, Kan.
S. E. Price, D. D., president Ottawa University, Ottawa, Kan.
G. E. Raburn, 1919, teacher, Kansas State Agricultural College, Manhattan, Kan.
G. R. Randall, 1921, agricultural director, Marysville, Kan.
Roy Rankin, 1919, professor of Chemistry, Fort Hays Kansas Normal School, Hays, Kan.
E. F. A. Reinish, 1917, superintendent of parks, Topeka, Kan.
Mrs. C. I. Reed, 1918, instructor in zoölogy, University of Kansas, Lawrence, Kan.
C. I. Reed, 1920, assistant professor of physiology, University of Kansas, Lawrence, Kan.
W. E. Ringle, 1920, teacher, Pittsburg, Kan.
Vance N. Robb, 1921, ophthalmologist, Manhattan, Kan.

Eulalia E. Roseberry, B. S., 1909, professor of geography, State Manual Training Normal School, Pittsburg, Kan.

George E. Rex, 1911, Atchison, Topeka & Santa Fe Railway, Topeka.

W. R. B. Robertson, Ph. D., 1905, assistant professor of zoölogy, University of Kansas, Lawrence, Kan.

Elizabeth Rothermel, 1919, assistant professor of foods and nutrition, Kansas State Agricultural College, Manhattan, Kan.

Clifford S. Rude, 1918, assistant entomologist, Texas Experiment Station, College Station, Tex.

J. C. Russell, A. M., 1911, professor of chemistry, McPherson College, McPherson, Kan.

D. C. Schaffner, A. M., 1903, professor of zoölogy, College of Emporia, Emporia, Kan.

Charles A. Scott, 1919, nurseryman, Manhattan, Kan.

T. H. Scheffer, M. S., 1903, bureau of biological survey, Puyallup, Wash.

M. M. Schmidt, 1914, cashier of bank, Summerfield, Kan.

Sister M. Sebastian, Dodge City, Kan.

George C. Shadd, professor of electrical engineering, University of Kansas, Lawrence, Kan.

N. P. Sherwood, Ph. D., 1917, professor of bacteriology, University of Kansas, Lawrence, Kan.

W. D. Shewman, 1920, teacher of physics, Fort Hays Kansas Normal School, Hays, Kan.

J. A. G. Shirk, M. S., 1904, professor of mathematics, State Manual Training Normal School, Pittsburg, Kan.

C. J. Shirk, M. S., 1905, professor of botany, Nebraska Wesleyan University, University Place, Neb.

Ralph C. Shuey, 1905, 3306 West Sixty-seventh street, Chicago, Ill.

Charles A. Shull, Ph. D., 1917, professor of botany, University of Kentucky, Lexington, Ky.

R. R. Sigler, 1920, instructor in State Manual Training Normal School, Pittsburg, Kan.

Roger C. Smith, 1921, teacher, Kansas State Agricultural College, Manhattan, Kan.

E. Claude Smith, D. O. S., 1917, osteopath, Topeka, Kan.

W. C. Stevens, M. S., 1890, professor of botany, University of Kansas, Lawrence, Kan.

S. G. Stewart, M. D., 1904, Topeka, Kan.

O. O. Stoland, Ph. D., 1918, professor of physiology, University of Kansas, Lawrence, Kan.

G. W. Stratton, Ph. D., 1918, associate professor of chemistry, University of Kansas, Lawrence, Kan.

C. M. Sterling, A. B., 1904, assistant professor of pharmacognosy, University of Kansas, Lawrence, Kan.

Frank P. Strickland, jr., 1917, city chemist, Kansas City, Kan.

John Sundwall, Ph. D., M. D., University of Minnesota, Minneapolis, Minn.

M. C. Tanquary, Ph. D., 1912, Texas Experiment Station, College Station, Tex.

E. L. Tague, A. M., 1912, assistant professor of chemistry, Kansas State Agricultural College, Manhattan, Kan.

A. C. Terrill, E. M., A. M., Baxter Springs, Kan.

Helen B. Thompson, 1919, Kansas State Agricultural College, Manhattan, Kan.

George W. Tidd, 1914, Enid, Okla.

Eugene F. Tinker, 1919, Wesleyan University, Salina, Kan.

J. E. Todd, M. A., 1907, assistant professor of geology, University of Kansas, Lawrence, Kan.

David Train, 1907, Lindsborg, Kan.

Elbert S. Tucker, 1904, U. S. Entomological Laboratory, Tallulah, La.

W. H. Twenhofel, Ph. D., 1910, science hall, Madison, Wis.

Perley F. Walker, M. M. F., 1905, dean of the School of Engineering, University of Kansas, Lawrence, Kan.

Lalia V. Walling, A. M., 1918, instructor in physiology, University of Kansas, Lawrence, Kan.

Henry J. Waters, B. Sc., LL. D., 1909, editor Weekly Kansas City *Star*, Kansas City, Mo.

Charles H. Watson, 1919, teacher, Lawrence, Kan.

George N. Watson, A. B., B. Sc., assistant professor of pharmacy, University of Kansas, Lawrence, Kan.

Lawrence A. Walworth, 1913, taxidermist, Eleele, Kauai, Hawaii.

Edward R. Weidlein, A. M., professor of inorganic chemistry, University of Pittsburgh, Pittsburgh, Pa.

James R. Wells, 1920, instructor in biology, State Manual Training Normal School, Pittsburg, Kan.

E. A. White, A. M., 1904, assistant professor of chemistry, University of Kansas, Lawrence, Kan.

C. C. Williams, C. E., 1917, professor of railway engineering, University of Kansas, Lawrence, Kan.

Nettie Wismer, 1919, student, Manhattan, Kan.

W. B. Wilson, M. Sc., 1903, professor of biology, Ottawa University, Ottawa, Kan.

Guy West Wilson, A. M., M. Sc., Fayette, Iowa.

Henry Irwin Woods, A. M., 1903, professor of physics and astronomy, Washburn College, Topeka, Kan.

Thomas A. Wood, B. S., 1909, professor of blacksmithing, assistant professor of mathematics, Fort Hays Kansas Normal School, Hays, Kan.

C. M. Young, B. S., E. M., 1920, professor of mining engineering, University of Kansas, Lawrence, Kan.

Percy Young, 1920, department of zoölogy, Cornell University, Ithaca, N. Y.

PART II.

PAPERS—FIFTY-FIRST ANNUAL MEETING.

TITLES OF PAPERS,

FIFTY-FIRST ANNUAL MEETING.

THE CULTIVATION OF MEDICINAL PLANTS. *L. D. Havenhill.*

PATENT LAWS IN REGARD TO THE PROTECTION OF CHEMICAL INDUSTRY. *L. E. Sayre.*

SOME DRAGON FLIES OF SOUTHEASTERN KANSAS. *Vernon C. Allison.*

A LIST OF BUTTERFLIES OF CRAWFORD COUNTY, KANSAS. *Vance Randolph.*

THE WEAKENING EFFECT ON A SPECIES OF PLANTS OF BEING CONTINUALLY REPRODUCED BY ARTIFICIAL MEANS. *E. F. A. Reinisch.*

PROBLEMS IN ARTILLERY AMMUNITION DESIGN. *R. A. Seaton.*

FACTORS INFLUENCING THE TEACHING OF SCIENCE AND ENGINEERING. *A. A. Potter.*

A REVIEW OF THE LITERATURE ON THE RUSTS OF OATS, WITH NOTES ON THEIR DISTRIBUTION IN THE UNITED STATES. *John H. Parker.*

EXPLORATIONS OF THE PERMIAN OF TEXAS AND THE CHALK OF KANSAS, 1918. *Charles H. Sternberg.*

BOTANICAL NOTES FOR 1918-19. *Frank U. G. Agrelius.*

THE BANANA AS A FOOD PRODUCT. *J. M. McWharf.*

PROBABLE EOCENE GLACIAL DEPOSITS IN THE FORT APACHE REGION, ARIZONA. *Albert B. Reagan.*

GLACIAL DEPOSITS IN PINE RIVER VALLEY, COLORADO. *Albert B. Reagan.*

PLAGUE AMONG CHICKENS IN CENTRAL IOWA DURING THE SUMMER OF 1918. *Albert B. Reagan.*

THE "FLU" AMONG THE NAVAJOS. *Albert B. Reagan.*

SOME SUGGESTIONS ON CLIMATE. *Albert B. Reagan.*

SCIENTIFIC MEASUREMENT OF THE ACHIEVEMENTS OF PUPILS. *F. J. Kelly.*

STUDIES OF INSECTS ASSOCIATED WITH THE AMERICAN MISTLETOE. *Elbert S. Tucker.*

NOTES ON SOME FUNGI OF EASTERN KANSAS. *Guy West Wilson.*

EDIBLE MUSHROOMS OF KANSAS. *Elam Bartholomew.*

MORE EVIDENCE THAT PLATTE RIVER, NEBRASKA, FORMERLY CONNECTED WITH GRAND RIVER, MISSOURI. *James E. Todd.*

THE ELEODES OF RILEY COUNTY, KANSAS. *James W. McColloch.*

LACHNOSTERNA IN THE VICINITY OF MANHATTAN, KAN. *James W. McColloch and Wm. P. Hayes.*

NOTES ON LARVAL TREMATODES FROM THE LARAMIE PLAINS. *Earl C. O'Roke.*

PLANT DISEASES HERETOFORE UNREPORTED IN KANSAS—REPORTED IN 1914, 1915, 1916, 1917. *L. E. Melchers.*

PLANT DISEASE SURVEY REPORT FOR KANSAS, 1918. *L. E. Melchers.*

THE HOUSE FLY AND FOWL TAPEWORM TRANSMISSION. *James E. Ackert.*

STUDIES ON THE OCCURRENCE AND DEVELOPMENT OF ASCARIDIA PERSPICILLUM, PARASITIC IN CHICKENS. *Bertha L. Danheim.*

KANSAS RHYNCOPHORA IN THE COLLECTION OF THE KANSAS STATE AGRICULTURAL COLLEGE. *Wm. P. Hayes.*

HELIUM AS A BALLOON GAS. *Hamilton P. Cady.*

THE EARTH-MOON THEORY. *Leroy Hughbanks.*

A STUDY OF THE OIL FROM SUMAC (RHUS GLABRA.) *H. W. Brubaker.*

PART III.

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FIFTY-SECOND ANNUAL MEETING.

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STANDARDS OF PURITY FOR MEDICINAL AGENTS. *L. E. Sayre.*

BOTANICAL NOTES, 1919-1920. *Frank U. G. Agrelius.*

A PRELIMINARY LIST OF INSECTS OF THE SORGHUM FIELD. *Wm. P. Hayes.*

HOW TO DETERMINE ALTITUDES SATISFACTORILY WITH AN ANEROID BAROMETER. *J. E. Todd.*

ARCHÆOLOGICAL NOTES ON PINE RIVER VALLEY, COLORADO, AND THE KAYENTA-TUBA REGION. *Albert B. Reagan.*

A LIST OF THE CICADELLIDÆ OF KANSAS. *P. B. Lawson.*

A LIST OF THE GRASSES OF DOUGLAS COUNTY. *P. B. Lawson.*

FIELD WORK IN KANSAS AND TEXAS. *Charles H. Sternberg.*

EDUCATION: PHYSICAL AND MENTAL. *J. M. McWharf.*

FOSSILS FROM THE WESTERN FRONT. *Frank P. Strickland, Jr.*

AN ANNOTATED LIST OF SOME KANSAS PLEUROSTICTI (SCARABÆIDÆ). *J. W. McCulloch and W. P. Hayes.*

A PRELIMINARY STUDY OF THE LIFE HISTORY AND HABITS OF DIONE VANILLÆ. *Vance Randolph.*

A KITCHEN DISINFECTANT. *F. A. Patty and L. E. Sayre.*

PLANT-DISEASE SURVEY REPORT FOR KANSAS, 1919. *L. E. Melchers.*

PART IV.

PAPERS—FIFTY-THIRD ANNUAL MEETING.

TITLES OF PAPERS,

FIFTY-THIRD ANNUAL MEETING.

PUBLIC BATHS AND THEIR HYGIENIC OR SANITARY VALUE. *J. M. McWharf.*
COLOR IN NATURE. *J. E. Todd.*
A NEW NESTING RECORD FOR THE PINE SISKIN. *F. F. Crevecoeur.*
ADDITIONS TO THE LIST OF KANSAS LEPIDOPTERA. *F. F. Crevecoeur.*
ADDITIONS TO THE LIST OF KANSAS HYMENOPTERA. *F. F. Crevecoeur.*
NATURE'S USE OF DISINFECTANTS AND ANTISEPTICS. *L. E. Sayre.*
BOTANICAL NOTES FOR 1920. *Frank U. G. Agrelius.*
ARCHÆOLOGY OF THE TUBA-KAYENTA REGION. *Albert B. Reagan.*
SOME NOTES ON THE LUMMI-NOOKSACK INDIANS, WASHINGTON. *Albert B. Reagan.*
FLOOD MYTHS OF THE BOIS FORT CHIPPEWAS. *Albert B. Reagan.*
HUNTING AND FISHING OF VARIOUS TRIBES OF INDIANS. *Albert B. Reagan.*
FROGS AND FROGGING. *E. C. O'Roke.*
THE INDUSTRIAL RESEARCH MOVEMENT OF TO-DAY. *W. F. Faragher.*